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ABSTRACT

Conducted during the 1979-80 school year, this study gathered statistical information as to the success of the developmental mathematics program at Arkansas State University (ASU). The investigation focused on a comparison between Foundation Mathematics students who took Basic Mathematics as a follow-up course and pupils who enrolled in Basic Mathematics without first taking Foundation Mathematics. Success was determined by looking at the grades achieved by both groups of pupils in Basic Mathematics. Among the findings, the data revealed that 32 of 38 pupils who took Basic Mathematics after Foundation Mathematics passed: whereas, only 33 of 50 pupils who took Basic Mathematics alone were successful. The information provided by this investigation supported the hypothesis that the developmental mathematics program at ASU is "doing its job," with Foundation Mathematics successfully serving as a preparatory class for Basic Mathematics. (MP)

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ARE DEVELOPMENTAL PROGRAMS AT THE COLLEGE LEVEL DOING THEIR JOB?

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INTRODUCTION

This study was conducted to gain statistical information as to the success of the developmental mathematics program at Arkansas State University (ASU). It was decided that measuring the success of students who completed the developmental math program would be one means of establishing the success of the program. Success was determined by looking at the grades achieved in subsequent credit math classes. The hypothesis was that students who completed the developmental math class would be more successful in credit math classes than students who were academically eligible for developmental math but proceeded to college credit math classes without first taking the developmental math class.

BACKGROUND AND DESCRIPTION

Faced with the dilemma of decreasing enrollment, many American institutions of higher learning are recruiting students who "don't belong." They do not belong in college in the sense that they are not prepared to meet the academic, psychological, and emotional demands placed on them in the university environment. The incentives for these students to attend college are multiple: (1) Parents generally prefer that their child's next step in life after high school graduation be to attend college (Hickson, 1978); (2) The availability of financial aid; and (3) The recruiting efforts of universities.

Because of the increased pressure felt by many institutions to maintain enrollment levels, recruiting efforts include attracting high school graduates who are not prepared for post-secondary education.

Any high school graduate, or any adult; regardless of his previous educational background, may be admitted to a university with an "open-door" admission policy. Universities with an "open-door" admission policy can alleviate the enrollment problem by admitting marginally prepared students into college, but by doing so are creating another problem of even greater magnitude; keeping these students academically eligible to continue their post-secondary education. This task has prompted many universities to implement developmental educational programs into their curriculums. Such programs are designed to increase the retention and graduation rates of students who would normally "flunk or drop out." The form and function of these programs vary (Clowes, 1979), but all include some combination of classes, counseling, and/or tutoring. The availability of developmental educational programs makes the "open door" a reality for many of the potential students in that developmental classes provide the opportunity for an open door to success rather than failure. Now the big question arises: Are these programs successfully doing their job?

Foundation Mathematics is a non-credit, developmental math class whose purpose is to prepare a student to take Basic Mathematics, a college credit math course. The objective is to raise the basic skill competencies of a student in mathematics to an academic level capable of mastering Basic Math concepts. At ASU, students who qualify

for Foundation Math are economically, culturally, or educationally deprived, and, according to their American College Test (ACT) probability scores, have less than 38 chances out of 100 to make a grade of "C" or better in a regular college level math course.

A study was conducted at ASU during the 1978-79 school year to determine if Foundation Mathematics, UC 10013X, whose primary purpose is to prepare students for Basic Mathematics, was indeed achieving its objectives (Smith, 1979). The study included three hypotheses: (1) Testing the validity of criterion used for student placement into Foundation Mathematics; (2) Determining whether students in a developmental math class can demonstrate significant improvement of basic skills with only one semester of preparation; and (3) determining if Foundation Math is successfully serving as a preparatory class for Basic Math.

Each hypothesis was tested by comparing mean scores on a standardized test (Stanford TASK, Math Sub-Test, Forms A & B). The statistical "t" was used for inferential parametric analysis. The t test analyzed computed means for three groups: (1) Pre-test/pre-test comparison of Foundation Math students with Basic Math students; (2) Pre-test/post-test comparison of Foundation Math students; and (3) Post-test/pre-test comparison, respectively, of Foundation Math students with Basic Math students.

Results were favorable for each of the three objectives. The mean score of the Foundation Math pre-test was significantly lower than the mean score of the Basic Math pre-test. Thus, the criterion

used for placement into Foundation Math is valid. The mean score of the Foundation Math post-test was significantly higher than the Foundation Math pre-test. Students in a developmental class can improve their competency of basic skills with one semester of preparation. There was no significant difference between the Foundation Math post-test mean and the Basic Math pre-test mean. Foundation Math is successfully serving as a preparatory class for Basic Math.

However, further evidence was desired to support the hypothesis that Foundation Math is doing its job, i.e., it is successfully preparing students for Basic Math. Thus, a follow-up study was conducted during the 1979-80 school year. The progress of each student in Foundation Math in the original study has been charted. Data has been collected on those students who went on to enroll in Basic Math or any other subsequent math course. The students who took Basic Math in the Spring of 1979 and were participants of the original study have also been followed. The Basic Math grades of those who should have taken Foundation Math, according to their ACT probability score, but did not, are of particular interest to the follow-up study.

INVESTIGATION

This study contains statistical data about 62 students who completed Foundation Mathematics in the Fall semester of the 1978-79 academic year. This group will be identified as Group 1. Students enter Foundation Math for one of three reasons: (1) The student's probability score on the ACT was less than 38; (2) The student requested to enter

the class; and/or (3) The student was referred to the program by a counselor, faculty advisor, or instructor. The participants and reasons for enrolling in Foundation Math are presented in Table 1. As illustrated, the great majority of students enter Foundation Math because of low probability scores on their ACT.

Table 1

Foundation Mathematics Participants

Reason for being in Foundation Mathematics	Number of Participants	Percent of Participants
Probability score less than 38	53	85.6
Student's Request	1	1.6
Referral to the class	8	12.8
TOTALS	62	100.0

Although Foundation Math is designed to be a preparatory course for Basic Math and students are generally advised to proceed into Basic Math, some students state a specific desire to enter other math courses. This investigator found that students followed Foundation Math with one of these four courses: Basic Math, Algebra with Application to Business and Social Sciences, Intermediate Algebra, and College Algebra. Fifteen of the 62 students have not taken a follow-up course. Of these 15, 11 are no longer enrolled at Arkansas State University. The data in Table 2 reflects the distribution of the students enrolled in follow-up courses.

Table 2

Foundation Mathematics Participants

Distribution in Follow-Up Math Courses

Course	No. Taken
Basic Math	38
Algebra with Application to Business & Social Sciences	4
Intermediate Algebra	4
College Algebra	1
SUB-TOTAL	47
Have not taken follow-up course	15*
TOTAL	62

*Eleven not presently enrolled at ASU

This study also contains statistical data about students who completed Basic Mathematics, Math 10103, in the Spring semester of the 1978-79 academic year. Two hundred fifty-seven Basic Math students were pre-tested. Forty-five students were deleted from the original analysis because they had either (1) previously taken Foundation Math, or (2) were repeating Basic Math. This investigation focused on 50 of the remaining 212 because the probability score on the math section of their ACT was 38 or less. Those students who did not take Foundation Math form Group 2.

RESULTS

The data in Table 3 illustrates the number and percentages of grades A, B, C, D, F, W, and WP for Grouplin each of the four

follow-up courses. At the time of this investigation, no Group 1 students had withdrawn from a follow-up course with a failing grade (WF).

Table 3

Group 1

Number and Percentages of

Grades A, B, C, D, F, W, and WP

For Follow-Up Courses

MATH COURSE		A	B	C	D	F	W	WP	TOTALS
Basic Math	#	0	7	15	10	4	1	1	38
	%	0.0	18.5	39.5	26.3	10.5	2.6	2.6	100.0
Algebra Bus./Soc. Sci.	#	0	1	2	0	1	0	0	4
	%	0.0	25.0	20.0	0.0	25.0	0.0	0.0	100.0
Intermediate Algebra	#	1	1	0	0	1	0	1	4
	%	25.0	25.0	0.0	0.0	25.0	0.0	25.0	100.0
College Algebra	#	0	0	0	0	1	0	0	1
	%	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
TOTALS	#	1	9	17	10	7	1	2	47
	%	2.0	19.2	36.3	21.3	14.9	2.0	4.3	100.0

The data in Table 4 illustrates the number and percentages of grades A, B, C, D, F, W, and WP for Group 2. No student in Group 2 had withdrawn from Basic Math with a failing grade (WF).

Table 4

Group 2

Number and Percentages of

Grades A, B, C, D, F, W, and WP

For Basic Math

MATH COURSE		A	B	C	D	F	W	WP	TOTALS
Basic Math	#	2	4	18	9	6	9	2	50
	%	4.0	8.0	36.0	18.0	12.0	18.0	4.0	100.0

Since the primary purpose of Foundation Math is to prepare students for Basic Math, as documented by Smith (1979), this investigation focused on a comparison between Foundation Math students who took Basic Math as a follow-up course and students who enrolled in Basic Math with an ACT probability score of 38 or less without first taking Foundation Math. The data in Table 5 illustrates this comparison.

Table 5

Group 1 - Group 2: Basic Math Grade Comparison

GROUP		A	B	C	D	F	W	WP	TOTALS
1	#	0	7	15	10	4	1	1	38
	%	0.0	18.5	39.5	26.3	10.5	2.6	2.6	100.0
2	#	2	4	18	9	6	9	2	50
	%	4.0	8.0	36.0	18.0	12.0	18.0	4.0	100.0

This investigation is concerned with the success of students who completed Foundation Mathematics before taking Basic Mathematics.

In this study, success is determined by a student receiving a passing grade (A, B, C, D) in Basic Math. Referring to the data in Table 5, 84.2% of the students in Group 1 passed Basic Math, as compared to 66.0% of the students in Group 2. Computing a Z score to test the significance between two independent proportions, one derives a Z value of 1.94, which indicates a significant difference between Group 1 and Group 2 at the .05 level of confidence for a one-directional test.

ANALYSIS OF DATA

The analysis of data involved both descriptive and influential statistical techniques. Simple percentages were computed in describing both groups of participants.

Parameters computed for analysis purposes were the standard error of the difference between two proportions and the normal deviate, Z score. The statistical Z score was used for the inferential parametric analysis. The Z score analysis involved the comparison of two independent proportions: (1) Students in Group 1 receiving a passing grade in Basic Math; and (2) Students in Group 2 receiving a passing grade in Basic Math.

SUMMARY OF FINDINGS

The primary objective of developmental educational classes is to assist underprepared students in progressing to an academic level capable of being able to enroll in and successfully complete college credit courses. The study conducted in the 1978-79 academic school

year showed that Foundation Mathematics, UC 10013X, was successfully preparing students for entry into Basic Math, 10103. The data collected in this investigation shows that students who completed Foundation Math were better able to successfully complete Basic Math. Thirty-two of the 38 students (84.2%) in Group 1 who took Basic Math passed; whereas, 33 of the 50 students (66.0%) in Group 2 received passing grades. Students with a probability score of 38 or less on the math section of their ACT who took Foundation Math achieved significantly better grades than students with a probability score of 38 or less on the math section of their ACT Profile who did not take Foundation Math. Group 1 students were more successful in Basic Math than students in Group 2.

For various reasons, 17.7 percent of Group 1 had not taken a follow-up course when this study was conducted. At the time of this investigation, 11 of the 15 students who had not taken a follow-up course were not enrolled at ASU. It should be pointed out that no one was dismissed because of academic reasons. Of the 11 students not at ASU, six did not return after the semester in which they completed Foundation Math. Four students from Group 1 were enrolled at ASU at the time of this study, but had not taken a follow-up college credit math course. The success of these students should show up in a later study.

In conclusion, the investigation contributed support to the hypothesis that developmental programs at the college level are doing their job. Students who completed Foundation Math were better prepared to enter Basic Math and successfully complete it than students who were academically eligible for Foundation Math but did not take it.

COMMENTS

Developmental educational programs are not "miracle workers." However, they are needed as long as institutions admit minimally-prepared students into the academics of higher education. As students, faculty advisors, and the general public become more familiar with developmental educational programs and confident in their value, the programs will receive more support and will be better able to aid more of those students who actually need the assistance of developmental programs. For now, interested educators need to continue evaluative procedures which will help in documenting the worth of such programs.

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